CLAIMS

1. A method of cooling a boil off gas stream (01) from a liquefied cargo in a floating transportation vessel, said liquefied cargo having a boiling point of greater than -110 °C at 1 atmosphere, said method comprising at least the steps of:
   - compressing a boil off gas stream (01) from said liquefied cargo in three or more stages of compression comprising at least a first stage (65), a second stage (70) and final stage (75) to provide a compressed discharge stream (06), wherein intermediate compressed BOG streams (02, 04) are provided between consecutive stages of compression;
   - cooling the compressed discharge stream (06) to provide a cooled compressed discharge stream (07);
   - heat exchanging an expanded, optionally further cooled, portion of the cooled compressed discharge stream (07), with (i) one or more intermediate compressed BOG streams (04) from consecutive stages selected from between the second and final stages (75) of compression to provide one or more cooled intermediate compressed BOG streams (05) and optionally (ii) one or more portions (07a, 108a), optionally after further cooling, of the cooled compressed discharge stream (07); and
   - passing the one or more cooled intermediate compressed BOG streams (05) to the next stage of compression (75).

2. The method of claim 1 comprising at least the steps of:
   - compressing the boil off gas stream (01) in a first stage (65) of compression to provide a first intermediate compressed BOG stream (02) as an intermediate compressed BOG stream;
   - compressing the first intermediate compressed BOG stream (02), optionally after heat exchange to provide a cooled first intermediate compressed BOG stream (03), in a second stage (70) of compression to provide a second

intermediate compressed BOG stream (04) as an intermediate compressed BOG stream.

3. The method of claim 1 or claim 2 further comprising the steps of:
- splitting the cooled compressed discharge stream (07) into a continuing cooled compressed discharge stream (07a) and a cooled compressed discharge side stream (09);
- expanding the cooled compressed discharge side stream (09) to provide a expanded cooled discharge stream (19).

4. The method of claim 3 further comprising the step of:
- heat exchanging the expanded cooled discharge stream (19) with an intermediate compressed BOG stream (04) from consecutive stages selected from between the second and final stages (70, 75) of compression to provide a cooled intermediate compressed BOG stream (05).

5. The method of claim 3 comprising the further step of:
- flashing the expanded cooled discharge stream (19) to provide an overhead expanded cooled discharge stream;
- heat exchanging the overhead expanded cooled discharge stream (21) with an intermediate compressed BOG stream (04) from consecutive stages selected from between the second and final stages (70, 75) of compression to provide a cooled intermediate compressed BOG stream (05).

6. The method of claim 4 or claim 5 wherein the intermediate compressed BOG stream (04) is a second intermediate compressed BOG stream and the cooled intermediate compressed BOG stream (05) is a cooled second intermediate compressed BOG stream.

7. The method of any one of claims 3 to 6 comprising the further step of:

- heat exchanging the expanded cooled discharge stream (19) with the continuing cooled compressed discharge stream (07a) to provide a further cooled compressed discharge stream (108).

8. The method of claim 7 comprising the further steps of:
- splitting the further cooled compressed discharge stream (108) into a continuing further cooled compressed discharge stream (108a) and a further cooled compressed discharge side stream (11);
- expanding the further cooled compressed discharge side stream (11) to provide an expanded further cooled discharge stream (21).

9. The method of claim 8 comprising the further step of:
- heat exchanging the expanded further cooled discharge stream (21) with an intermediate compressed BOG stream (02) from consecutive stages selected from between the first and final stages (65, 70, 75) of compression to provide a cooled intermediate compressed stream (03).

10. The method of claim 8 comprising the further step of:
- flashing the expanded further cooled discharge stream (21) to provide an overhead expanded further cooled discharge stream;
- heat exchanging the overhead expanded further cooled discharge stream with an intermediate compressed BOG stream (02) from consecutive stages selected from between the first and final stages (65, 70, 75) of compression to provide a cooled intermediate compressed BOG stream (03).

11. The method of claim 9 or claim 10 wherein the intermediate compressed BOG stream (02) is a first intermediate compressed BOG stream and the cooled intermediate compressed BOG stream (03) is a cooled first intermediate compressed BOG stream.

12. The method of any one of claims 9 to 11 comprising the further step of:

- heat exchanging the expanded further cooled discharge stream (21) with the continuing further cooled compressed discharge stream (108a) to provide a cooled return stream (08).

13. The method of claim 12 further comprising the step of:
- expanding the cooled return stream (08) to provide an expanded cooled return stream (10).

14. The method according to any of the preceding claims wherein the liquefied cargo is LPG, such as LPG comprising at least 3.5 mol% ethane.

15. The method of any of the preceding claims wherein the compressed discharge stream (06) is cooled against a water stream, such as a seawater stream, to provide the cooled compressed discharge stream (07).

16. The method of any of the preceding claims wherein the first stage (65), second stage (70) and final stage (75) of compression are stages of a multi-stage compressor (60).

17. An apparatus to cool a boil off gas stream (01) from a liquefied cargo in a floating transportation vessel, said liquefied cargo having a boiling point of greater than -110 °C at 1 atmosphere, said apparatus comprising at least:
- a compression system (60) to compress a boil off gas stream (01) from a liquefied cargo, said compression system comprising three or more stages of compression comprising at least a first stage (65), a second stage (70) and final stage (75) to provide a compressed discharge stream (06), wherein intermediate compressed BOG streams (02, 04) are provided between consecutive stages of compression,
- a first heat exchanger (200) to cool the compressed discharge stream (06) to provide a cooled compressed discharge stream (07);

- one or more further heat exchangers (190) to heat exchange an expanded, optionally further cooled, portion of the cooled compressed discharge stream (07), with (i) one or more intermediate compressed BOG streams (04) from consecutive stages selected from between the second and final stages (75) of compression to provide one or more cooled intermediate compressed BOG streams (05) to the next stage of compression (75) and optionally (ii) one or more portions (07a, 108a), optionally after further cooling, of the cooled compressed discharge stream (07).

18. An apparatus according to claim 17 which is operable using the method of any one of claims 1 to 16.

CLAIMS

1. A method of cooling a boil off gas stream (01) from a liquefied cargo in a floating transportation vessel, said liquefied cargo having a boiling point of greater than -110 °C at 1 atmosphere and selected from the group comprising liquefied petroleum gas, liquefied petrochemical gas selected from propylene, and liquefied ammonia, said method comprising at least the steps of:
   - compressing a boil off gas stream (01) from said liquefied cargo in three or more stages of compression comprising at least a first stage (65), a second stage (70) and final stage (75) to provide a compressed discharge stream (06), wherein intermediate compressed BOG streams (02, 04) are provided between consecutive stages of compression;
   - cooling the compressed discharge stream (06) against a water stream to provide a cooled, fully condensed, compressed discharge stream (07);
   - heat exchanging an expanded, optionally further cooled, portion of the cooled, fully condensed, compressed discharge stream (07), with (i) one or more intermediate compressed BOG streams (04) from consecutive stages selected from between the second and final stages (75) of compression to provide one or more cooled intermediate compressed BOG streams (05) and optionally (ii) one or more portions (07a, 108a), optionally after further cooling, of the cooled compressed discharge stream (07); and
   - passing the one or more cooled intermediate compressed BOG streams (05) to the next stage of compression (75).

2. The method of claim 1 comprising at least the steps of:
   - compressing the boil off gas stream (01) in a first stage (65) of compression to provide a first intermediate compressed BOG stream (02) as an intermediate compressed BOG stream;
   - compressing the first intermediate compressed BOG stream (02), optionally after heat exchange to provide a cooled first intermediate compressed BOG stream (03), in a second stage (70) of compression to provide a second

intermediate compressed BOG stream (04) as an intermediate compressed BOG stream.

3. The method of claim 1 or claim 2 further comprising the steps of:

- splitting the cooled, fully condensed, compressed discharge stream (07) into a continuing cooled compressed discharge stream (07a) and a cooled compressed discharge side stream (09);
- expanding the cooled compressed discharge side stream (09) to provide a expanded cooled discharge stream (19).

4. The method of claim 3 further comprising the step of:

- heat exchanging the expanded cooled discharge stream (19) with an intermediate compressed BOG stream (04) from consecutive stages selected from between the second and final stages (70, 75) of compression to provide a cooled intermediate compressed BOG stream (05).

5. The method of claim 3 comprising the further step of:

- flashing the expanded cooled discharge stream (19) to provide an overhead expanded cooled discharge stream;
- heat exchanging the overhead expanded cooled discharge stream (21) with an intermediate compressed BOG stream (04) from consecutive stages selected from between the second and final stages (70, 75) of compression to provide a cooled intermediate compressed BOG stream (05).

6. The method of claim 4 or claim 5 wherein the intermediate compressed BOG stream (04) is a second intermediate compressed BOG stream and the cooled intermediate compressed BOG stream (05) is a cooled second intermediate compressed BOG stream.

7. The method of any one of claims 3 to 6 comprising the further step of:

- heat exchanging the expanded cooled discharge stream (19) with the continuing cooled compressed discharge stream (07a) to provide a further cooled compressed discharge stream (108).

8. The method of claim 7 comprising the further steps of:
- splitting the further cooled compressed discharge stream (108) into a continuing further cooled compressed discharge stream (108a) and a further cooled compressed discharge side stream (11);
- expanding the further cooled compressed discharge side stream (11) to provide an expanded further cooled discharge stream (21).

9. The method of claim 8 comprising the further step of:
- heat exchanging the expanded further cooled discharge stream (21) with an intermediate compressed BOG stream (02) from consecutive stages selected from between the first and final stages (65, 70, 75) of compression to provide a cooled intermediate compressed stream (03).

10. The method of claim 8 comprising the further step of:
- flashing the expanded further cooled discharge stream (21) to provide an overhead expanded further cooled discharge stream;
- heat exchanging the overhead expanded further cooled discharge stream with an intermediate compressed BOG stream (02) from consecutive stages selected from between the first and final stages (65, 70, 75) of compression to provide a cooled intermediate compressed BOG stream (03).

11. The method of claim 9 or claim 10 wherein the intermediate compressed BOG stream (02) is a first intermediate compressed BOG stream and the cooled intermediate compressed BOG stream (03) is a cooled first intermediate compressed BOG stream.

12. The method of any one of claims 9 to 11 comprising the further step of:

- heat exchanging the expanded further cooled discharge stream (21) with the continuing further cooled compressed discharge stream (108a) to provide a cooled return stream (08).

13. The method of claim 12 further comprising the step of:
- expanding the cooled return stream (08) to provide an expanded cooled return stream (10).

14. The method according to any of the preceding claims wherein the liquefied cargo is LPG, such as LPG comprising at least 3.5 mol% ethane.

15. The method of any of the preceding claims wherein the compressed discharge stream (06) is cooled against a seawater stream, to provide the cooled compressed discharge stream (07).

16. The method of any of the preceding claims wherein the first stage (65), second stage (70) and final stage (75) of compression are stages of a multi-stage compressor (60).

17. An apparatus to cool a boil off gas stream (01) from a liquefied cargo in a floating transportation vessel, said liquefied cargo having a boiling point of greater than -110 °C at 1 atmosphere and selected from the group comprising liquefied petroleum gas, liquefied petrochemical gas selected from propylene, and liquefied ammonia, said apparatus comprising at least:
- a compression system (60) to compress a boil off gas stream (01) from a liquefied cargo, said compression system comprising three or more stages of compression comprising at least a first stage (65), a second stage (70) and final stage (75) to provide a compressed discharge stream (06), wherein intermediate compressed BOG streams (02, 04) are provided between consecutive stages of compression,

- a first heat exchanger (200) to cool the compressed discharge stream (06) against a water stream to provide a cooled, fully condensed, compressed discharge stream (07);
- a first discharge stream pressure reduction device (120) to expand an optionally further cooled, portion of the cooled, fully condensed, compressed discharge stream (07) to provide an expanded, optionally further cooled portion of the cooled, fully condensed, compressed discharge stream,
- one or more further heat exchangers (190) to heat exchange an expanded, optionally further cooled, portion of the cooled, fully condensed, compressed discharge stream (07), with (i) one or more intermediate compressed BOG streams (04) from consecutive stages selected from between the second and final stages (75) of compression to provide one or more cooled intermediate compressed BOG streams (05) to the next stage of compression (75) and optionally (ii) one or more portions (07a, 108a), optionally after further cooling, of the cooled compressed discharge stream (07).

18. An apparatus according to claim 17 which is operable using the method of any one of claims 1 to 16.